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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/820,494	04/07/2004	Kishor V. Desai	03-2198/LSI1P242	7404
24319	7590	11/16/2005	EXAMINER	
LSI LOGIC CORPORATION 1621 BARBER LANE MS: D-106 MILPITAS, CA 95035			SEFER, AHMED N	
			ART UNIT	PAPER NUMBER
			2826	

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/820,494

Applicant(s)

DESAI ET AL.

Examiner

A. Sefer

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-14 and 29-35 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-14 and 29-35 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

1. The amendment filed September 8, 2005 has been entered. Claims 1 and 15-28 have been cancelled and new claims 29-35 have been added.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 2-4 and 9 are rejected under 35 U.S.C. 102(b) as being anticipated by Bunyan (“Bunyan”) USPN 6,432,497.

Bunyan discloses in fig. 1 a semiconductor package comprising: a packaging substrate 14; a semiconductor die 12 mounted with the substrate; a heatspreader 22 and a multi-layer heat transfer element 23 arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader wherein the multi-layer heat transfer element includes a core spacer element 30 having a top surface and a bottom surface; a first layer 20 of thermally conductive reflowable material formed on the top surface; and a second layer 18 of thermally conductive reflowable material formed on the bottom surface.

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Regarding claim 3, Bunyan discloses the die 12 being attached to the second layer 18 and wherein the heat spreader 22 is attached to the first layer 20.

As to the reflow process recited in the claim, it refers to a process and "product by process" claims are directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685 and In re Thorpe, 227 USPQ 964, 966. Therefore, the way the product was made does not carry any patentable weight as long as the claims are directed to a device. Further, note that the applicant has the burden of proof in such cases, as the above case law makes clear. Also see MPEP 2113.

Regarding claim 4, Bunyan discloses (paragraph bridging cols. 9 and 10) the core spacer element 30 being comprised of conducting materials.

Regarding claim 9, Bunyan discloses (col. 10, lines 60-67) the core spacer element 30 being comprised of conducting resin material.

4. Claims 2, 4, 5, 7, 8, 10 and 11 are rejected under 35 U.S.C. 102(e) as being anticipated by Chen et al. ("Chen") USPN 6,716,676.

Chen discloses in fig. 7 a semiconductor package comprising: a packaging substrate 300; a semiconductor die 320 mounted with the substrate; a heatspreader 370 and a multi-layer heat transfer element (321, 332, 321/375) arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader wherein the multi-layer heat transfer element includes a core spacer element 332 having a top surface and a bottom surface; a first layer 321/375 of thermally conductive reflowable material formed on the top surface; and a second layer 321 of thermally conductive reflowable material formed on the bottom surface.

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Regarding claims 4 and 5, Chen discloses the core spacer element 332 being comprised of conducting materials or metal (as in claim 5).

Regarding claims 7 and 8, Chen discloses in fig. 3B vias 333 that penetrate through the core spacer element or dimples formed therein (as in claim 8).

Regarding claim 10, Chen discloses the first layer and the second layer each comprising solder materials.

Regarding claim 11, Chen discloses the semiconductor die being mounted to the packaging substrate using a plurality of solder bumps 311; wherein the packaging substrate includes a stiffener 350 element that is mounted between the heat spreader and the substrate.

5. Claims 2-10, 12 and 13 are rejected under 35 U.S.C. 102(e) as being anticipated by Karnezos ("Karnezos") USPN 6,906,416.

Karnezos discloses in fig. 5 a semiconductor package comprising: a packaging substrate; a semiconductor die 414/514 mounted with the substrate; a heatspreader 530 and a multi-layer heat transfer element (521, 512, 523) arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader wherein the multi-layer heat transfer element includes a core spacer element 512 having a top surface and a bottom surface; a first layer 523 of thermally conductive reflowable material formed on the top surface; and a second layer 521 of thermally conductive reflowable material formed on the bottom surface.

Regarding claim 3, Karnezos discloses the die 514 being attached to the second layer 521 and wherein the heat spreader 530 is attached to the first layer 523.

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As to the reflow process recited in the claim, it refers to a process and "product by process" claims are directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685 and *In re Thorpe*, 227 USPQ 964, 966. Therefore, the way the product was made does not carry any patentable weight as long as the claims are directed to a device. Further, note that the applicant has the burden of proof in such cases, as the above case law makes clear. Also see MPEP 2113.

Regarding claims 4-6 and 9, Karnezos discloses (col. 16, lines 13-38) the core spacer element 512 being comprised of conducting materials or metal (as in claim 5) or layers of metal (as in claim 6) or conducting resin material (as in claim 9).

Regarding claims 7 and 8, Karnezos discloses vias 522 that penetrate through the core spacer element or dimples formed therein (as in claim 8).

Regarding claim 10, Karnezos discloses the first layer and the second layer each comprising solder materials.

Regarding claim 12, Karnezos discloses the first layer being formed of a solder material that has good adhesion to a material comprising a surface of the heat spreader; and wherein the second layer being formed of a solder material that has good adhesion to a material comprising a top surface of the die.

Regarding claim 13, Karnezos discloses (col. 16, lines 13-38) core spacer 512 comprising a thermally non-conductive material and wherein the core spacer element includes a plurality of vias 522 that penetrate through the core spacer element; wherein reflowable material of at least of the first material and the second material fills at least a portion of the vias so that said first

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layer and second layer are in physical contact with each other, thereby establishing thermal communication between the die and the heat spreader.

6. Claims 2-3 and 10-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Oman ("Oman") USPN 6,873,043.

Oman discloses in figs. 1 and 2 a semiconductor package comprising: a packaging substrate 14; a semiconductor die 12 mounted with the substrate; a heatspreader 26 and a multi-layer heat transfer element 32 arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader wherein the multi-layer heat transfer element includes a core spacer element 36 having a top surface and a bottom surface; a first layer 38 of thermally conductive reflowable material formed on the top surface; and a second layer 34 of thermally conductive reflowable material formed on the bottom surface.

Regarding claim 3, Oman discloses the die 12 being attached to the second layer 34 and wherein the heat spreader 26 being attached to the first layer 38.

As to the reflow process recited in the claim, it refers to a process and "product by process" claims are directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685 and *In re Thorpe*, 227 USPQ 964, 966. Therefore, the way the product was made does not carry any patentable weight as long as the claims are directed to a device. Further, note that the applicant has the burden of proof in such cases, as the above case law makes clear. Also see MPEP 2113.

Regarding claim 10, Oman discloses (col. 4, lines 15-20) the first layer and the second layer each comprise solder materials.

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Regarding claim 11, Oman discloses the semiconductor die being mounted to the packaging substrate using a plurality of solder bumps (col. 5, lines 15-17); wherein the packaging substrate includes a stiffener 44/46 element that is mounted between the heat spreader and the substrate.

Regarding claim 12, Oman discloses the first layer being formed of a solder material that has good adhesion to a material comprising a surface of the heat spreader; and wherein the second layer being formed of a solder material that has good adhesion to a material comprising a top surface of the die.

7. Claims 2-6, 10, 12 and 14 are rejected under 35 U.S.C. 102(e) as being anticipated by Dyckman et al. ("Dyckman") USPN 6,657,864.

Dyckman discloses in fig. 1 a semiconductor package comprising: a packaging substrate 30; a semiconductor die 20 mounted with the substrate; a heatspreader 70 and a multi-layer heat transfer element (62, 50, 63) arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader wherein the multi-layer heat transfer element includes a core spacer element 50 having a top surface and a bottom surface; a first layer 63 of thermally conductive reflowable material formed on the top surface; and a second layer 62 of thermally conductive reflowable material formed on the bottom surface.

Regarding claim 3, Dyckman discloses the die 20 being attached to the second layer 62 and wherein the heat spreader 70 being attached to the first layer 63.

As to the reflow process recited in the claim, it refers to a process and "product by process" claims are directed to the product per se, no matter how actually made, In re Hirao, 190

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USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685 and *In re Thorpe*, 227 USPQ 964, 966. Therefore, the way the product was made does not carry any patentable weight as long as the claims are directed to a device. Further, note that the applicant has the burden of proof in such cases, as the above case law makes clear. Also see MPEP 2113.

Regarding claims 4-6, Dyckman discloses the core spacer element 50 being comprised of conducting materials or metal (as in claim 5) or layers of metal -- thin and thick portions of layer 50 -- (as in claim 6).

Regarding claim 10, Dyckman discloses the first layer and the second layer each comprise solder materials.

Regarding claim 12, Dyckman discloses the first layer being formed of a solder material that has good adhesion to a material comprising a surface of the heat spreader; and wherein the second layer being formed of a solder material that has good adhesion to a material comprising a top surface of the die.

Regarding claim 14, Dyckman discloses the backside of the packaging substrate has a plurality of solder balls 35 configured for attaching and electrically connecting the package with a circuit board 40; and the heat spreader being attached the first layer, the die being attached to the second layer, solder balls of the substrate being attached the circuit board.

As to the reflow process recited in the claim, it refers to a process and "product by process" claims are directed to the product per se, no matter how actually made, *In re Hirao*, 190 USPQ 15 at 17 (footnote 3). See also *In re Brown*, 173 USPQ 685 and *In re Thorpe*, 227 USPQ 964, 966. Therefore, the way the product was made does not carry any patentable weight as long

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as the claims are directed to a device. Further, note that the applicant has the burden of proof in such cases, as the above case law makes clear. Also see MPEP 2113.

8. Claim 29 is rejected under 35 U.S.C. 102(b) as being anticipated by Bunyan.

Bunyan discloses in fig. 1 a semiconductor package comprising: a packaging substrate 14; a semiconductor die 12 mounted with the substrate; a heatspreader 22 and a multi-layer heat transfer element 23 arranged between the semiconductor die and the heat spreader to enable thermal communication between the die and the heat spreader wherein the multi-layer heat transfer element includes a core spacer element 30 having a top surface and a bottom surface; a first layer 20 of thermally conductive reflowable material formed on the top surface of the core spacer and in contact with the heat spreader; and a second layer 18 of thermally conductive reflowable material formed on the bottom surface and in contact with the die.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 30-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bunyan.

Bunyan discloses the device structure as recited in the claim but does not specifically disclose a thickness of first/second layers or the cumulative thickness of the heat transfer element. However, it would have been obvious to one skilled in the art at the time the invention was made to meet the recited thickness of the first/second layers or the heat transfer element

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since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art.

In re Aller, 105 USPQ 233.

Response to Arguments

11. Applicant's arguments filed 9/8/05 have been fully considered but they are not persuasive.

12. Applicants argue that Bunyan ("Bunyan") USPN 6,432,497; Chen et al. ("Chen") USPN 6,716,676; Karnezos ("Karnezos") USPN 6,906,416; Oman ("Oman") USPN 6,873,043; and Dyckman et al. ("Dyckman") USPN 6,657,864 do not disclose or suggest all the elements either explicitly or inherently.

Specifically, Applicants argue that:

- Bunyan requires a double sided interface that requires PSA layers 36 and 38, which are not the same as reflow materials taught by the present invention, to adhere the heatspreader to a die and that significant processing time, effort and money are lost preparing the devices for pressure treatment to adhere the die to the heatsink.

- Chen's multi-layer heat transfer element is NOT arranged between the die 320 and the heat spreader 370 and that there is no indication of a reflow material being used to attach the die to the heat spreader and core as required by the claims.

- Karnezos does not disclose a multi-layer heat transfer element arranged between the die (e.g., 513) and the heat spreader 530 and that Karnezos' element 512 is a package substrate such as dies are commonly mounted on.

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- Oman does not teach a reflowable first and second layers and the rectangular copper sheets 34 and 38, which are not solder or other reflow materials as required by the claims, would make the structure too thick and too difficult to manufacture.

- Dyckman's elastomer 62, 63 are not the same as reflow materials taught by the present invention and that Dyckman's technology creates thick thermal layers between the die the heatspreader relative to the claimed invention thereby increasing overall package thickness.

10. In response to the argument that Bunyan requires a double sided interface that requires PSA layers 36 and 38, which are not the same as reflow materials taught by the present invention, Bunyan discloses a multi-layer heat transfer element including a core spacer element 30 having a top surface and a bottom surface; a first layer 20 of thermally conductive reflowable material formed on the top surface; and a second layer 18 of thermally conductive reflowable material formed on the bottom surface. Therefore, Applicant's arguments do not comply with 37 CFR 1.111(c) because they do not clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the reference cited.

13. In response to the argument that Chen's multi-layer heat transfer element is NOT arranged between the die 320 and the heat spreader 370, Chen discloses a semiconductor die 320 mounted with a substrate; a heatspreader 370 and a multi-layer heat transfer element (321, 332, 321/375) arranged between the semiconductor die and the heat spreader. As to the argument that that the reference fails to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a reflow material being used to attach the die to the heat spreader and core) are not recited in the rejected claim(s). Although the claims are

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interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

14. In response to the argument that Karnezos does not disclose a multi-layer heat transfer element arranged between the die (e.g., 513) and the heat spreader 530, Karnezos discloses a heatspreader 530 and a multi-layer heat transfer element (521, 512, 523) arranged between a semiconductor die 414/514 and the heat spreader to enable thermal communication between the die and the heat spreader. It is held, absent evidence to the contrary that Karnezos' device is capable of performing a thermal communication between the die and the heat spreader.

Furthermore, Karnezos' element 512 is comprised of a conductive material or metal and the argument that element 512 is not a core configured for heat transfer is not supported by Karnezos' disclosure.

15. In response to the argument that Oman does not teach a reflowable first and second layers and the rectangular copper sheets 34 and 38, which are not solder or other reflow materials as required by the claims, would make the structure too thick and too difficult to manufacture, Oman discloses that elements 34 and 38 are comprised of copper and it is held, absent evidence to the contrary that elements 34 and 38 are reflow materials. As to the argument that Oman's invention would yield a structure too thick and too difficult to manufacture, it fails to comply with 37 CFR 1.111(b) because it amounts to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

16. In response to the argument that Dyckman's elastomer 62, 63 are not the same as reflow materials taught by the present invention, Dyckman discloses a multi-layer heat transfer element

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including a core spacer element 50 having a top surface and a bottom surface; a first layer 63 of thermally conductive reflowable material formed on the top surface; and a second layer 62 of thermally conductive reflowable material formed on the bottom surface. It is held, absent evidence to the contrary that elements 62, 63 are reflow materials. As to the argument that Dyckman's technology creates thick thermal layers between the die and the heatspreader relative to the claimed invention thereby increasing overall package thickness, it fails to comply with 37 CFR 1.111(b) because it amounts to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

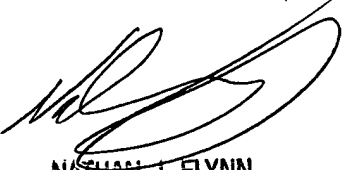
Any inquiry concerning this communication or earlier communications from the examiner should be directed to A. Sefer whose telephone number is (571) 272-1921.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-1915.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ANS
November 7, 2005



NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800